

GALIUM ANGLICUM (RUBIACEAE) NEW FOR TEXAS AND NOTES
ON THE TAXONOMY OF THE *G. PARISIENSE/DIVARICATUM* COMPLEX

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ABSTRACT

Galium parisiense var. *leiocarpum* is documented as a first record for Texas and South Carolina. Other localities in the eastern U.S.A. are mapped for the glabrous-fruited expression of *G. parisiense* (var. *leiocarpum*), bristly-fruited *G. parisiense* (var. *parisiense*), and the closely related, glabrous-fruited *G. divaricatum*. All taxa are European natives. In both North America and Europe, var. *parisiense* and var. *leiocarpum* have distinct geographic ranges and occur sympatrically in some areas. *Galium divaricatum* occurs sympatrically at least with var. *leiocarpum*. We suggest that specific rank is appropriate for each of the three taxa, as *G. parisiense* L., *G. divaricatum* Pourret ex Lam., and *G. anglicum* Hudson (= *G. parisiense* var. *leiocarpum*).

RESUMEN

Galium parisiense var. *leiocarpum* se documenta como primera cita para Texas. Otras localidades del este de U.S.A. se cartografían para la expresión de frutos glabros de *G. parisiense* (var. *leiocarpum*), frutos con cerdas *G. parisiense* (var. *parisiense*), y la especie próxima de frutos glabros *G. divaricatum*. Todos los taxa son nativos de Europa. Tanto en Norte América como en Europa, var. *parisiense* y var. *leiocarpum* tienen rangos geográficos distintos y aparecen como simpátricos en algunas áreas. *Galium divaricatum* es simpátrico al menos con var. *leiocarpum*. Lo mismo parece ser cierto en Europa. Sugerimos que el rango específico es el apropiado para cada uno de los tres taxa, como *G. parisiense* L., *G. divaricatum* Pourret ex Lam., y *G. anglicum* Hudson (= *G. parisiense* var. *leiocarpum*).

A collection of *Galium anglicum* Hudson is reported here as the first known record of the species for Texas.

Galium anglicum Hudson (= *G. parisiense* L. var. *leiocarpum* Tausch, see below)

TEXAS. Gillespie Co.: LBJ National History Park, Ranch Unit, along southern half of LBJ landing strip, gentle slope, ungrazed, redeveloping prairie, apparently locally common but difficult to see among other prairie and weedy plants in disturbed area of caliche fill, 1 Jun 2005, Roger Sanders 6681 (BRIT).

The plant was collected and correctly identified by Sanders in connection with a floristic study of LBJ National History Park in central Texas. In our own evaluation of the Texas plant, we agree with Sanders' identification, but in comparing it to other collections from the eastern U.S.A, we observe that *Galium parisiense* has often been confused in identification with *G. divaricatum* Pourret ex Lam. The two taxa are similar and apparently closely related, and both are native to Europe. *Galium divaricatum* has been treated as a variety of *G. parisiense* (see below) but is more generally recognized as a distinct species. Ehrendorfer & Krendl (1976, p. 36) noted that *G. divaricatum* is "not very variable, and usually quite distinct from [*G. parisiense*]."

Part of the taxonomic difficulty stems from variation in fruit morphology in *Galium parisiense*. Plants of the typical expression have fruits hispid with uncinat-tipped hairs, while fruits of var. *leiocarpum* are glabrous (*G. divaricatum* also is glabrous-fruited). In Europe, Ehrendorfer and Krendl (1976) implied that the glabrous-fruited phase of *G. parisiense* was to be treated as a population variant without formal taxonomic status; the fruits of *G. parisiense* were described as glabrous or hairy. In the Flora of Turkey, Ehrendorfer and Schönbeck-Temesy (1982) also described *G. parisiense* (without infraspecific taxa) as producing both fruit types. Joao do Amaral (1971) followed Flora Europaea in treating *G. parisiense* sensu lato in Portugal as variable in fruit vestiture and distinct from *G. divaricatum*.

In contrast to the broad concept of *Galium parisiense*, in continental Europe it is described as having hairy fruits (e.g. Pignatti 1982; Schönbeck-Temesy & Ehrendorfer 1991) without mention of glabrous forms.

In the British Isles, the fruits are described as glabrous or papillose (e.g., Butcher 1961, and as illustrated; Clapham, Tutin, & Moore 1989; Stace 1997) without mention of hairy forms. Brenan (1953) reported a collection of var. *parisiense* from England, noting that “typical *G. parisiense*, though apparently not previously recorded from Britain, has a wide distribution in Europe and the Mediterranean Region, extending to the Middle East.” Boulos (2000) included the bristly-fruited form (as *G. parisiense*), based on collections from Cyprus. Only glabrous-fruited plants occur in Madeira (Turland 1994). For Spain, Devesa (1987) included bristly-fruited *G. parisiense* (widely distributed) and glabrous-fruited *G. divaricatum* (restricted to near-coastal localities, sympatric with *G. parisiense*), but the illustration of *G. divaricatum* in Devesa’s treatment apparently shows *G. parisiense* var. *leiocarpum*. All three taxa have been included for Portugal (Pereira Coutinho 1939; Sampaio 1946) and for France (e.g., Lamarck & de Candolle 1805; Grenier & Godron 1850; Coste 1901), although using various nomenclature. In summary, it appears that the two expressions of *G. parisiense* in Europe have distinct geographic ranges and probably occur sympatrically in some areas.

Glabrous-fruited plants, all reported as *Galium divaricatum*, are widespread in Australia (e.g., Toelken 1986; Rye 1987; James & Allen 1992) and New Zealand (Webb et al. 1988) and rare in Hawaii (Wagner et al. 1999). Descriptions of these do not provide information that allows their unequivocal identification as *G. divaricatum* (vs. *G. parisiense* var. *leiocarpum*). A bristly-fruited taxon is not included in current floristic summaries from these areas, although Webb et al. (1988, p. 1146) noted that earlier literature had “mentioned a bristly-fruited var. of *G. parisiense* occasionally found in N.Z.”

Taxonomic assessments of *Galium* California, Oregon, and the Pacific coast region have recognized a bristly-fruited taxon (as *G. parisiense*) and glabrous-fruited one (as *G. divaricatum*, including as synonyms *G. parisiense* var. *leiocarpum* and *G. anglicum* Hudson) (e.g., Jepson 1925; Howell 1943; Munz & Keck 1959; Munz 1974; Dempster 1993; Ferris 1960; Hitchcock & Cronquist 1976; Peck 1961; Kozloff 2005; Oregon State Univ. Herbarium 2007). Ceska and Ceska (1998) reported “*G. parisiense*” from British Columbia, but the morphology of the plant (A. Ceska pers. comm.) refers it to *G. parisiense* var. *leiocarpum*. Sanders (1999) reported *G. parisiense*, referring to the bristly-fruited taxon (Sanders pers. comm.), as widespread in cismontane southern California. We have seen (indicated below as “!”) relatively few specimens from the Pacific coast region and do not attempt here to resolve the geography of *G. divaricatum* vs. *G. parisiense* var. *leiocarpum*. In summary from literature and herbarium:

bristly-fruited in (California) Butte!, Calaveras, Colusa!, El Dorado!, Fresno, Humboldt!, Lake!, Los Angeles!, Mariposa!, Marin!, Mendocino, Monterey!, Napa!, Orange, San Bernadino, San Diego, Santa Cruz, Sonoma!, and Tuolumne! counties; (Oregon) Douglas, Jackson, and Josephine counties; (Washington) Kittitas and Pacific counties.

glabrous-fruited in (California) Alameda, Butte, Calaveras, Contra Costa, El Dorado, Humboldt, Lake, Marin, Mendocino, Napa!, Nevada, Plumas, Santa Clara, Santa Cruz, Shasta, Sonoma!, and Yuba counties; (Oregon) Benton!, Curry, Douglas, Jackson, Lane, Marion, and Polk counties; (British Columbia) Lasqueti Island.

Both bristly-fruited plants and glabrous-fruited plants are recorded from Calaveras, Humboldt, Lake, Marin, Mendocino, Napa, and Sonoma counties (California) and Jackson Co. (Oregon).

Our own observations of plants in the eastern U.S.A. indicate that the bristly-fruited and glabrous-fruited forms of *G. parisiense* have discrete geographic ranges (Fig. 1). *Galium divaricatum* occurs in Missouri, Indiana, Tennessee, and Alabama; *G. parisiense* sensu stricto occurs in Arkansas, Louisiana, Mississippi, Tennessee, and Alabama; *G. parisiense* var. *leiocarpum* occurs from the Atlantic region westward to Oklahoma and Texas, and it appears to be sympatric with typical *G. parisiense* in Alabama. As a speculative and probably over-simplified hypothesis, we might suggest that the wider range of var. *leiocarpum* has resulted from a greater number of introductions than for the other two taxa.

Fruit variation in *Galium*

Production in *Galium* of bristly fruits (vs. fruits with glabrous, hairless, surfaces) usually is a consistent character and indicator of close relationship among species (e.g., Dempster 1978, 1980, 1981–1982; Ehren-dorfer & Krendl 1976), but variation within species exists in a few instances. Moore (1975, p. 881) described fruits of *G. aparine* L. as “surface covered with stiff, hooked hairs (spines) ... the spines sometimes sparse

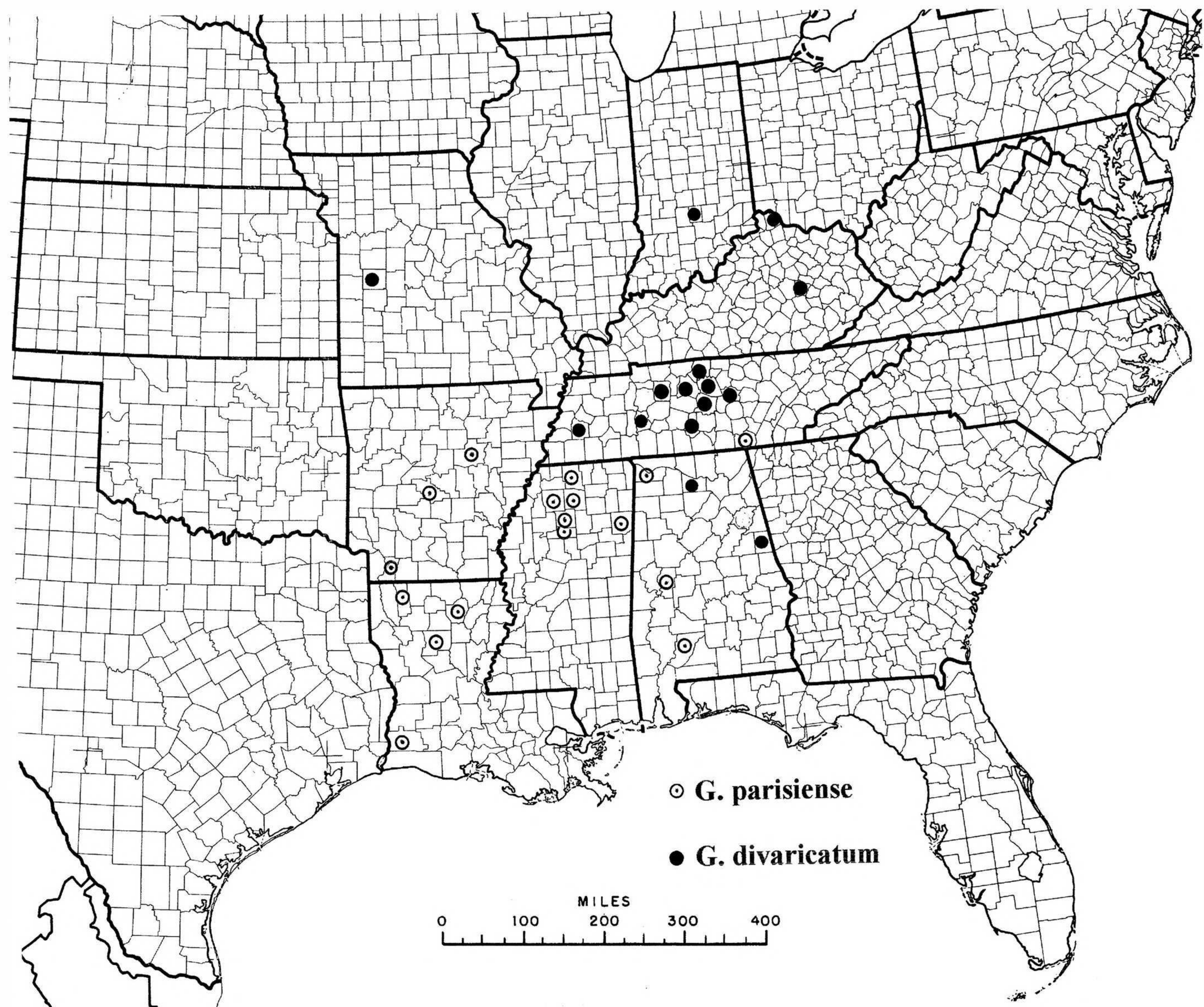


FIG. 1. Distribution of *Galium divaricatum* and *G. parisiense* in the eastern United States.

or, very rarely, lacking and the surface smooth or tuberculate.” He treated the glabrous-fruited plants as *G. aparine* forma *intermedium* (Bonnet) R.J. Moore but noted that “this rare form has not been seen” in a study of 280 Canadian collections of the species. Nor do we observe glabrous-fruited plants of *G. aparine* in ca. 350 collections (BRIT, TEX, VDB) of the species from the U.S.A.

Similar variation in fruit vestiture apparently exists in *Galium spurium* L. (if treated as a species distinct from *G. aparine*). Bristly-fruited plants are the more common in Europe and Canada and are treated variously, e.g., *G. vaillantii* DC., *G. spurium* var. *vaillantii* (DC.) Gren. & Godr., *G. spurium* forma *vaillantii* (DC.) R.J. Moore. Kaplan and Řehořek (1998) stated that variation in *G. parisiense* is analogous to that in *G. spurium*, but in study of herbarium collections and wild populations of *G. parisiense* (in Slovakia) they noted (p. 54) that “the characteristics of the fruit are usually common to all members of a population.” Consistent morphology within a population is not inconsistent with the hypothesis that sympatric populations of different morphology may be reproductively isolated.

Taxonomy of the *Galium parisiense* group

Four general taxonomic options exist: **1)** treat *Galium parisiense* with two varieties, distinct from *G. divaricatum* in habit and inflorescence (following *Flora Europaea*), implying that the two varieties of *G. parisiense* intergrade; **2)** treat glabrous-fruited *G. divaricatum* as a species with two varieties, distinct from *G. parisiense*, implying that the difference between var. *leiocarpum* and *G. divaricatum* is arbitrary or intergrading, as ap-

parently implied by California treatments; **3**) treat three taxa within a single species, as *G. parisiense*; **4**) treat each of the three taxa at specific rank, recognizing that each appears to be distinct and reproductively isolated from the other two. Our limited study suggests that the fourth option is most appropriate; Lid (1967) followed this course for Canary Island plants. As reviewed above, the three taxa occupy distinct geographic ranges and occur sympatrically in their native range in Europe as well as where naturalized in North America—along the Pacific Coast region and in the eastern U.S.A. Local populations appear to be consistent in fruit and inflorescence morphology. Broad sympatry among the taxa naturalized in North America and elsewhere outside the native range provides critical information pertinent to their biology and taxonomic rank. Because of the widely inconsistent taxonomic treatment of these taxa, however, especially in Europe, and because they are becoming nearly cosmopolitan weeds, the taxonomy and geography deserve more comprehensive study.

The following key and taxonomic paragraphs summarize our observations and conclusions. Maps are constructed from specimens examined in the current study (from BRIT-SMU, NCU, TENN, TEX-LL, and VDB) are indicated by counties of occurrence within a state. Plants from Missouri, Oklahoma, and West Virginia were observed from photocopies provided by SMS, OKLA, and WVA, respectively.

KEY TO *GALIUM PARISIENSE*, *G. DIVARICATUM*, AND *G. ANGLICUM*

1. Inflorescence relatively diffuse, branches divaricate; ultimate fruits (2–)3–6(–7) nodes beyond primary stem axis (with largest leaves); first inflorescence internode (beyond primary stem axis) 15–50 mm long; fruit surface glabrous (without hairs) _____ **G. divaricatum**
1. Inflorescence relatively strict, branches ascending; ultimate fruits 2–3(–4) nodes beyond primary stem axis (with largest leaves); first inflorescence internode (beyond primary stem axis) 3–12(–20) mm long; fruit surface glabrous or bristly-hispid.
 2. Fruit surface bristly-hispid with uncinat-tipped hairs, distinctly muriculate _____ **G. parisiense**
 2. Fruit surface without hairs, smooth to muriculate _____ **G. anglicum**

Color photos from Pinnacles National Monument in California (Morse 2007) show the contrast in the two inflorescence forms: one plant clearly is *G. divaricatum* but it is not possible to see the fruit vestiture on the other, which is either *G. anglicum* or *G. parisiense*. Color photos from the western Mediterranean region (Fundación Biodiversidad 2007) show the same contrast: one plant (as *G. parisiense* subsp. *divaricatum*) is *G. divaricatum*, while the other (as *G. parisiense* subsp. *parisiense*) is *G. anglicum* with glabrous fruits.

Galium divaricatum Pourret ex Lam., Encycl. 2:580. 1788. *Galium parisiense* var. *divaricatum* (Pourret ex Lam.) Koch, Syn. Fl. Germ. Helv., ed. 2, 3:1025. 1845 [non vis. 1852]. *Galium anglicum* var. *divaricatum* (Pourret ex Lam.) Reichb., Ic. Fl. Germ. Helv. 17: t. 1196, f. 2. 1854-1855. *Galium parisiense* subsp. *divaricatum* (Pourret ex Lam.) Rouy, Fl. France 8:46. 1903. TYPE: FRANCE: «Cette plante croit naturellement en France, aux lieux fablonneux & pierreux. M. Desfontaines l'a rencontrée dans le Berry; & M. l'Abbé. Pourret nous en a communiqué des individus qu'il a trouvés dans le Languedoc. (v.s.)»

Native range.—Southern Europe, Cyprus, Syria, Lebanon, Turkey, Czechoslovakia; «Albania?, Austria, Azores, Balearic Islands, Belgium, Bulgaria, Corsica, Crete, Czechoslovakia, France, Germany, Greece, Hungary, Italy, Portugal, Romania, Sardinia, Sicily, Spain, Switzerland, Yugoslavia, and Turkey» fide Ehrendorfer and Krendl (1976).

Naturalized.—Australia, New Zealand, Hawaii.

Occurrence in eastern USA.—(Fig. 1). ALABAMA (Morgan, Randolph), INDIANA (Brown), KENTUCKY (Campbell, Estill), MISSOURI (Greene), and TENNESSEE (Davidson, DeKalb, Dickson, Haywood, Marshall, Perry, Rutherford, Sumner, Wilson).

Galium parisiense L., Sp. Pl. 1:108. 1753. (**Figs. 1, 3**). TYPE: «Habitat in Anglia, Gallia.» The protologue notes «fructibus hispidis.»

Galium litigiosum DC. in Lam. & DC., Fl. France 4:263. 1805. *Galium anglicum* var. *litigiosum* (DC.) Koch, Syn. Fl. Germ. Helv., 331. 1837. *Galium divaricatum* var. *litigiosum* (DC.) Kostel, Ind. Hort. Bot. Prag., 61. 1844. *Galium parisiense* var. *litigiosum* (DC.) Arcang., Comp. Fl. Ital., 315. 1882. TYPE: France: various localities are cited in the protologue, which also notes «La plupart des auteurs ont

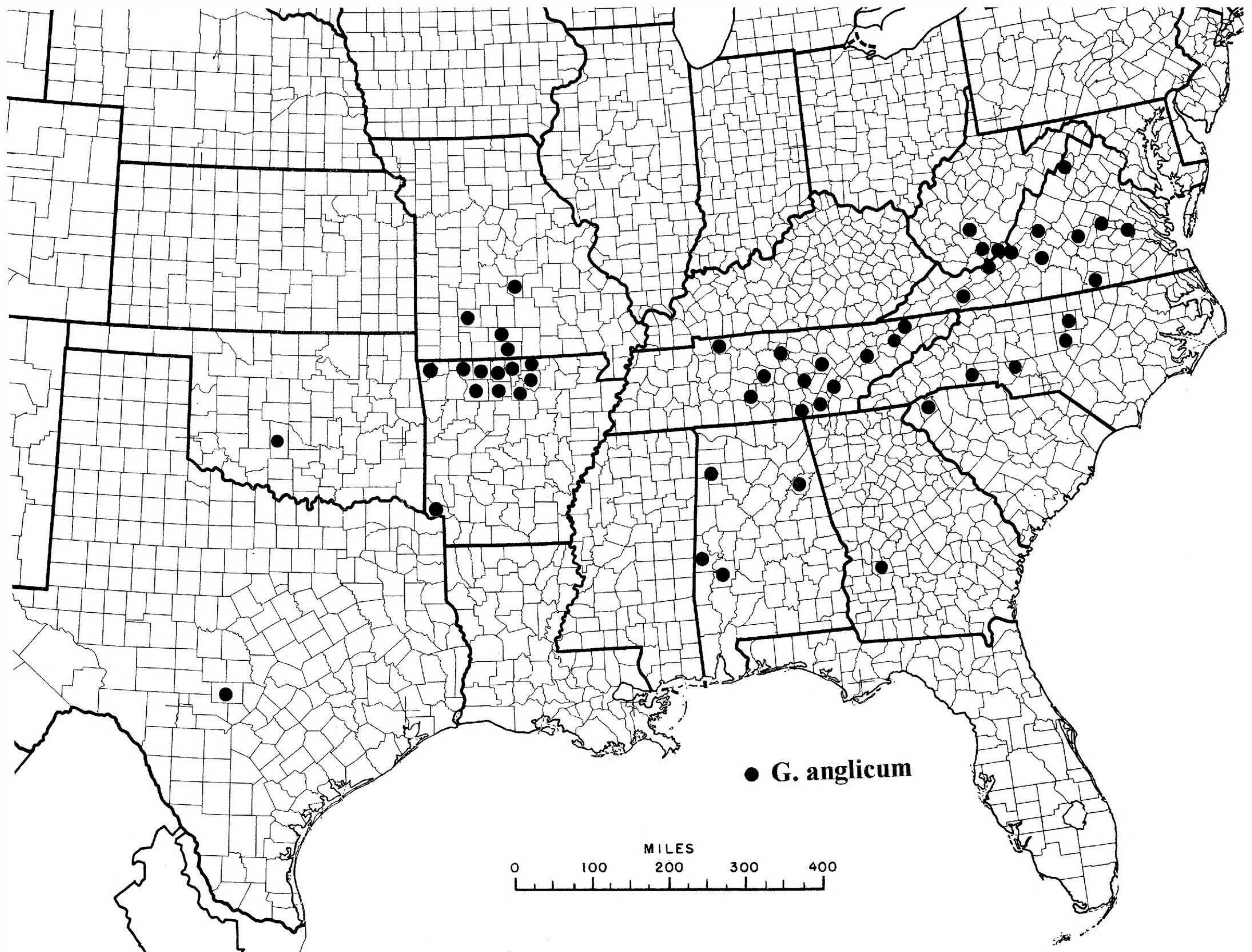


FIG. 2. Distribution of *G. anglicum* in the eastern United States.

confondu cette espèce avec le gaillet d'Angleterre [*Galium anglicum*], et il est en effet très-douteux que notre plante ait été jamais trouvée aux environs de Paris.» «*Galium parisiense*. Linn. spec. 157, excl. syn. Ray. et forsan. Tourn.» was cited in synonymy and the name *G. parisiense* was not applied to any other species. The fruit was described as hairy (“hérissé de poils”).

Galium decipiens Jordan, Obs. Pl. Crit. 3:178. 1846 (non Ehrhart 1790; non Roth 1827). TYPE: FRANCE: «J'AI OBSERVÉ CETTE ESPÈCE DANS PLUSIEURS LOCALITÉS DU MIDI, AUX ENVIRONS DE TARASCON, MONTPELLIER, CETTE, ETC. ELLE FLEURIT EN JUILLET.» JORDAN DESCRIBED THE FRUITS AS GLABROUS OR COMPLETELY COVERED WITH HAIRS AND NOTED «JE L'AI RENCONTRÉE TANTÔT À FRUITS GLABRES, TANTÔT À FRUITS VELUS.» Ehrendorfer and Krendl (1976) observed that “In S.W. Europe variants are found with few-flowered partial inflorescences and large fruits with hooked hairs (*G. decipiens* Jordan ...).”

Galium parisiense L. var. (α.) *trichocarpum* Tausch, Flora 18:354. 1835. TYPE: Tausch noted “*G. parisiense* L. Cand. (e specim. in herbar. Sieberi.)”

Native range.—Southern, western, and central Europe, Cyprus, Turkey, Bulgaria; “Albania, Austria, Azores, Balearic Islands, Belgium, Britain, Bulgaria, Corsica, Czechoslovakia, France, Germany, Hungary, Italy, Portugal, Romania, Sardinia, Sicily, Spain, Switzerland, and Yugoslavia fide Ehrendorfer and Krendl (1976).

Naturalized.—Chile (Dempster 1981), U.S.A., New Zealand.

Occurrence in eastern USA.—(Fig. 1). ALABAMA (Colbert, Hale, Monroe), ARKANSAS (Lafayette, Saline, White), LOUISIANA (Calcasieu, Ouachita, Webster, Winn), MISSISSIPPI (Grenada, Lafayette, Marshall, Monroe, Panola, Yalobusha), and TENNESSEE (Marion).

Galium anglicum Hudson, Fl. Angl., ed. 2, 1:69. 1778. (Fig. 2, 3). *Galium parisiense* subsp. *anglicum* (Hudson) Gaud., Fl. Helvet. 1:438. 1828. *Galium parisiense* var. *anglicum* (Hudson) G. Beck [nom. illeg.], Fl. Nied.-Österr. 2:1122. 1893. TYPE: ENGLAND: “Habitat in muris et pratis arenosis, inter Dartford et Northfleet, et supra murum in oppido Farningham in agro Cantiano.” Beck cited *G. parisiense* var. *leiocarpum* Tausch in synonymy. He noted that he had not observed the glabrous-fruited taxon in Austria.

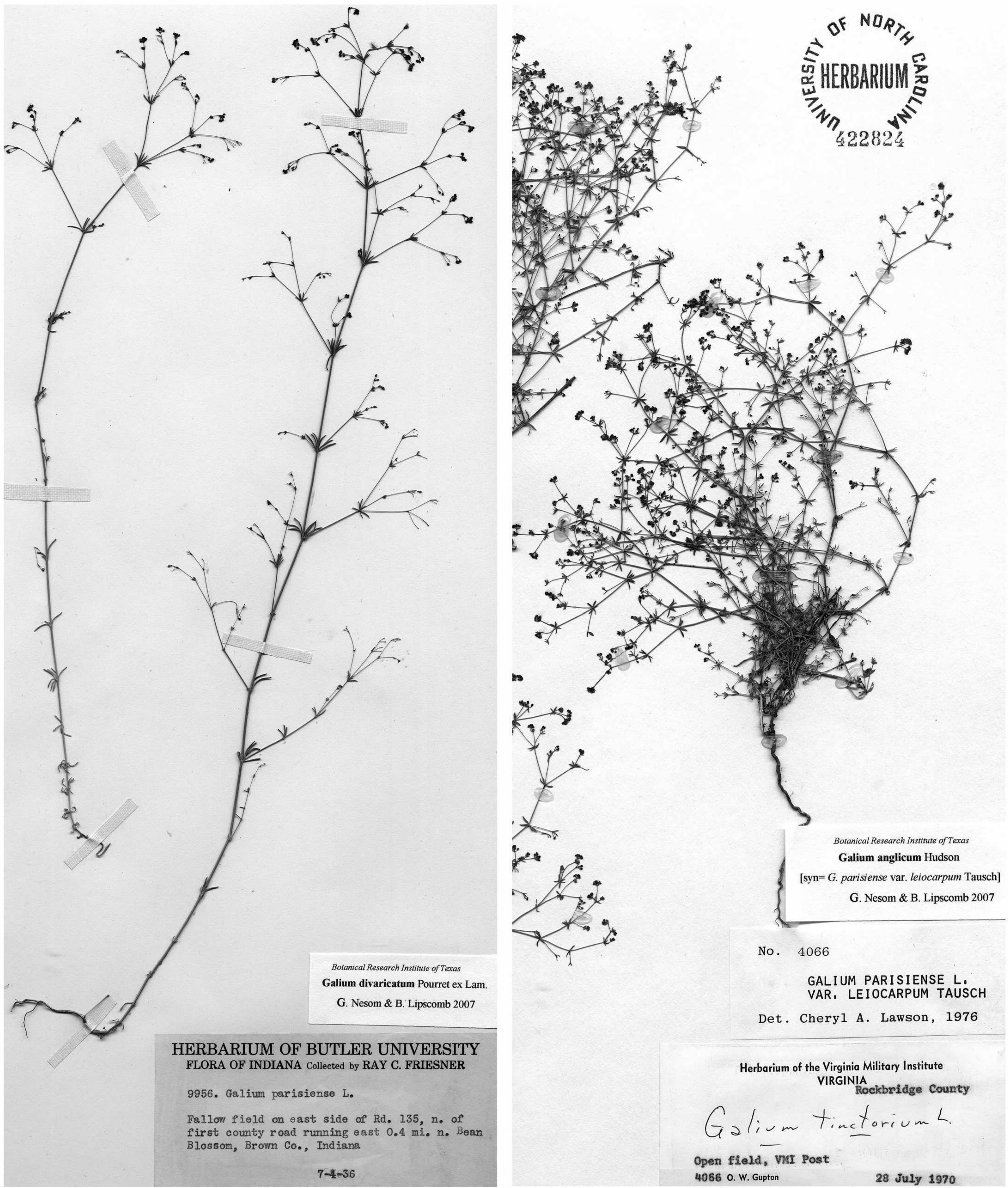


FIG. 3. Inflorescences of *Galium divaricatum* (left) and *G. anglicum* (right).

Galium parisiense L. var. (β .) *leiocarpum* Tausch, Flora 18:354. 1835. TYPE: Tausch noted "*G. anglicum* Huds. Cand. (ex phrasi excl. β . ad *G. divaricatum* spect.) Ray syn. t. 9. f. 1. (bona quoad habitum) Barr. ic. t. 58." Use of the name "forma *leiocarpum*" by Borza (1949, as "f. *leiocarpum* et f. *trichocarpum* Tausch.") was not a valid combination as no reference to the basionym was provided.

Native range.—England, France, Portugal, Spain?

Naturalized.—Australia, New Zealand, Hawaii (vs. *G. divaricatum*, see comments in text).

Occurrence in eastern USA.—(Fig. 2). ALABAMA (Calhoun, Marengo, Marion, Sumter), ARKANSAS (Baxter, Benton, Boone, Carroll, Fulton, Izard, Little River, Marion, Newton, Seracy, Stone), GEORGIA (Sumter),

MISSOURI (Douglas, Henry, Ozark, Pulaski), NORTH CAROLINA (Cabarrus, Chatham, Cleveland, Orange), OKLAHOMA (Grady), TENNESSEE (Cumberland, Hamblen, Hamilton, Hawkins, Knox, McMinn, Marion, Marshall, Montgomery, Rutherford, Smith, Van Buren), TEXAS (Gillespie), VIRGINIA (Bedford, Buckingham, Craig, Giles, Goochland, Henrico, Mecklenburg, Rockbridge, Shenandoah, Smyth), and WEST VIRGINIA (Fayette, Monroe, Summers).

The following collection is the first known record of *Galium anglicum* from South Carolina: Pickens Co.: Cedar Creek Circle, Central, scarce lawn week, 17 Jun 1989, Hill 20707 (MO).

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